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Assessing the Environmental Impacts of Disposable Facial Tissue Use Versus Reusable Cotton Handkerchiefs

621

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Introduction

Household use of disposable facial tissue can add up – a Kimberly Clark LCA reports that affluent households in the Eastern U.S. purchase and use 5,600 sheets of facial tissue a year per household (ref. 1). A previous LCA on reusable handkerchief versus disposable tissue use (ref. 2) found that handkerchiefs were environmentally superior, but the study only computed impacts for energy, water use, and waste, and also assumed a much longer lifespan of the handkerchief (520 washes) compared to previously published LCAs on textile products (50 washes) (ref. 3, ref. 4). For this process LCA, the cradle-to-grave environmental impacts of disposable paper facial tissue and reusable cotton handkerchiefs were evaluated using a functional unit (nose blows/area) which assessed the variations in product usage. Use scenarios for an average American adult living in New England were constructed and modeled to better understand how impacts can vary based on intensity of use, frequency of use, and time length of use, taking into account published information on nose blowing frequency in colds and frequency of respiratory illnesses (ref. 5, ref. 6).

For all one-year use scenarios, disposable facial tissues had lower environmental impacts in every IMPACT 2002+ midpoint and endpoint category relative to handkerchief use. Using handkerchiefs exclusively was only found environmentally preferable when used for the entire useful life of the handkerchief (50 washes, or 9.4 years), following a use pattern that led to the lowest handkerchief versus facial tissue use rate for the same number of nose blows (1 handkerchief vs. 5 tissues), due to higher intensity of handkerchief use prior to washing.

The electricity used in initial manufacturing of the handkerchief (producing the cotton yarn and weaving the cotton) dominated the impacts for all the use scenarios. Even with over 9 years of handkerchief washing, 65% of the climate change impacts are still due to handkerchief production. The impacts of electricity production (coal mining, coal burning, and coal ash disposal) dominated the Human Health, Climate Change, and Resources categories. Given the predominance of manufacturing in countries heavily reliant on coal-derived electricity, the environmental impacts of production of even the most simple of products can be significant.

vs.

200 count, 2-ply white facial tissues from leading U.S. brand, produced in Canada

6 pack 100% cotton handkerchiefs distributed by major U.S. retailer, produced in China

Goal & Scope: **to determine if an average American adult switched from using disposable paper facial tissue to reusable cotton handkerchiefs, would this result in lower environmental impacts**

System Boundary: **production, transport to retail, use, and disposal of the products and retail packaging**

Method: **model IMPACT 2002+, cradle-to-grave environmental impacts using product specifications, the Ecoinvent 2.2 database, along with published LCAs for the functional unit and 7 other use scenarios.**

Use scenarios

based on use during respiratory illnesses and base, well periods

Respiratory Illness: **8 nose blows/handkerchief, 2 nose blows/tissue, based on product surface area**

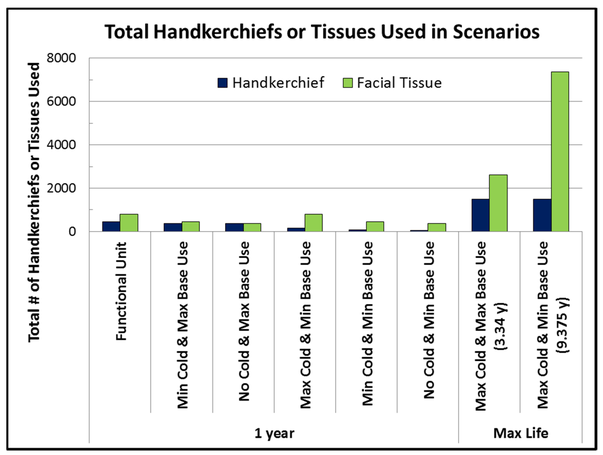
Max Cold: 2 nose blows/hr (ref. 5), cold lasting for 7 days, 4 colds/yr (ref. 6)
Min Cold: 0.9 nose blows/hr (ref. 5), cold lasting for 7 days, 2 colds/yr (ref. 6)
No Cold: 0 colds

Base Use: **Models daily or weekly handkerchief use before laundering**

Max Base Use: 7 nose blows/week, using 7 tissues or 7 handkerchiefs
Min Base Use: 7 nose blows/week, using 7 tissues or 1 handkerchief

Assumed 30 handkerchiefs in circulation, all 30 are washed at the same time with the individual's other laundry (handkerchiefs 6% of average laundry load by weight)

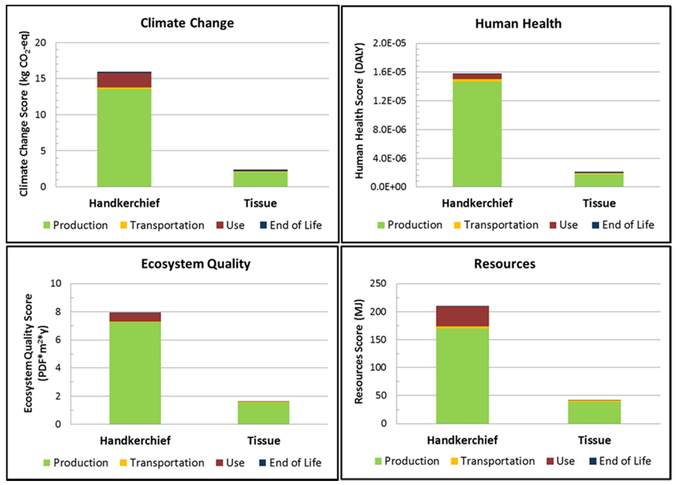
To visualize the differences between scenarios, the total number of handkerchiefs versus facial tissues are plotted blow. However, the scenarios are modeled based on 30 handkerchiefs in circulation and the number of times washed. Max Life = 50 washes (ref. 3, ref. 4)



Functional Unit

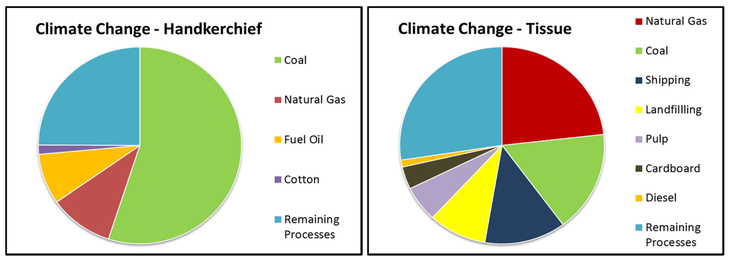
Functional Unit: the number of nose blows per surface area for an average American adult over 1 calendar year, encompassing the use pattern during 4 respiratory illnesses (896 nose blows) and daily use during well periods (337 nose blows).

- Based on Max Cold and Max Base Use assumptions
- Models use of 30 handkerchiefs washed 14.97 times (449 total handkerchiefs used) and 785 facial tissue over 1 year
- Represents a middling 1-year use scenario



Handkerchief use results in greater environmental impacts in every endpoint and midpoint category.

Impacts are dominated by the production of handkerchiefs and facial tissues. Disposal of the facial tissues accounts for 10% or less of environmental impacts, and washing of the handkerchiefs only contributed between 4 and 17 % of the endpoint impacts



Electricity used in textile production was the biggest driver of handkerchief climate impacts, with coal (the predominate source of electricity in China) the largest single contributor.

The major unit process contributors to facial tissue's climate impacts are more varied.

References

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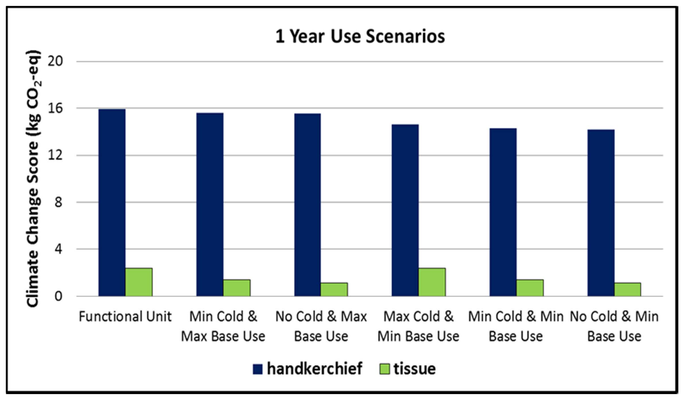
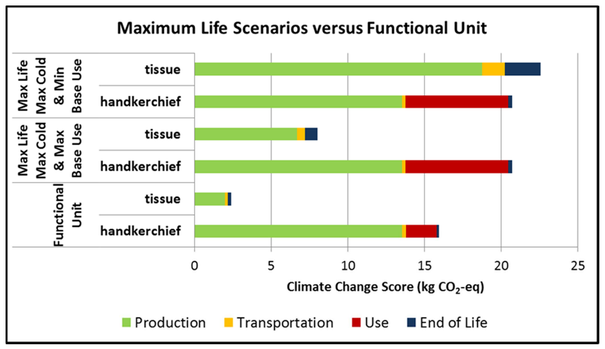
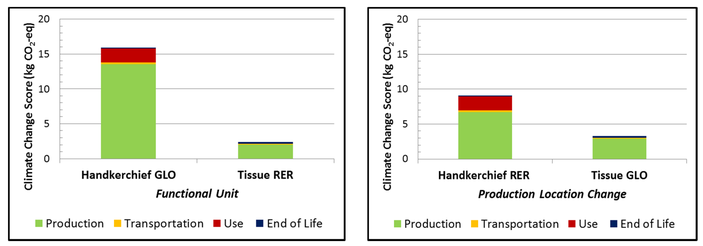
Sensitivity Analysis



No matter the use pattern, facial tissues have substantially lower impacts in all endpoint and midpoint categories for all one-year scenarios.



Handkerchiefs have only slightly lower environmental impacts when used for the entire life (over 9 years), and used much more intensively prior to washing.



Coal-based electricity dominated the impacts for the handkerchief scenarios. To evaluate if product production switched to a location less reliant on coal energy would impact the conclusions, the electricity mixes used to model the main product production steps for facial tissues and handkerchiefs were switched. Still, even when handkerchiefs are produced using a hydropower-rich electricity mix, the impacts are still greater than tissues produced mainly with coal-energy for all endpoint categories.

Using an alternative impact assessment model (ReCiPe 2008) did not change the conclusions.

Conclusions

- Switching from disposable facial tissues to reusable cotton handkerchiefs does not result in environmental benefits *except* under the scenario with the longest time frame (9.375 years) and the largest difference in facial tissue versus handkerchief use.
- Electricity used in textile production dominated the impacts irrespective of the electricity source. Handkerchief manufacturers can decrease environmental impacts by reducing the electricity used in weaving and yarn production.